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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/652,841	08/31/2000	Vishnu K. Agarwal	98-0616.02	4006

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EXAMINER

DIAZ, JOSE R

ART UNIT	PAPER NUMBER
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2815

DATE MAILED: 07/03/2002

Please find below and/or attached an Office communication concerning this application or proceeding.

**Office Action Summary**

Application No.

09/652,841

Applicant(s)

AGARWAL, VISHNU K.

Examiner

José R. Díaz

Art Unit

2815

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

**Period for Reply**

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

**Status**

- 1) ☒ Responsive to communication(s) filed on 09 May 2002.
- 2a) ☐ This action is FINAL. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

**Disposition of Claims**

- 4) ☒ Claim(s) 1-3 and 76-105 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1-3 and 76-105 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

**Application Papers**

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on \_\_\_\_\_ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☐ The proposed drawing correction filed on \_\_\_\_\_ is: a) ☐ approved b) ☐ disapproved by the Examiner.
- If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

**Priority under 35 U.S.C. §§ 119 and 120**

- 13) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some \* c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- \* See the attached detailed Office action for a list of the certified copies not received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).
- a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☒ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

**Attachment(s)**

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☒ Information Disclosure Statement(s) (PTO-1449) Paper No(s) 14.
- 4) ☐ Interview Summary (PTO-413) Paper No(s). \_\_\_\_\_.
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: \_\_\_\_\_.

## **DETAILED ACTION**

### ***Continued Examination Under 37 CFR 1.114***

➤ A request for continued examination under 37 CFR 1.114, including the fee set forth in 37 CFR 1.17(e), was filed in this application after final rejection. Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1.17(e) has been timely paid, the finality of the previous Office action has been withdrawn pursuant to 37 CFR 1.114. Applicant's submission filed on May 21, 2002 (Paper No. 11) has been entered.

### ***Claim Rejections - 35 USC § 102***

➤ The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(e) the invention was described in a patent granted on an application for patent by another filed in the United States before the invention thereof by the applicant for patent, or on an international application by another who has fulfilled the requirements of paragraphs (1), (2), and (4) of section 371(c) of this title before the invention thereof by the applicant for patent.

The changes made to 35 U.S.C. 102(e) by the American Inventors Protection Act of 1999 (AIPA) do not apply to the examination of this application as the application being examined was not (1) filed on or after November 29, 2000, or (2) voluntarily published under 35 U.S.C. 122(b). Therefore, this application is examined under 35 U.S.C. 102(e) prior to the amendment by the AIPA (pre-AIPA 35 U.S.C. 102(e)).

➤ Claims 1-3, 76-86 and 91-105 are rejected under 35 U.S.C. 102(e) as being anticipated by Agarwal et al. (US Patent No. 6,201,276 B1)

Regarding claims 1-3, 76, 78, 91-93 and 102-105, Agarwal et al. teach a method (see cols. 1-12) comprising the step of: providing a capacitor having a first plate (14), a dielectric (16a) over said first plate, and a second plate (18b, 16b, 18a, 19) over said dielectric, the second plate including first an second conductive (18b and 19) (see Fig. 5B). With regards to the limitation of forming a second conductive after the first conductive is exposed to an  $N_2/H_2$  plasma, Agarwal et al. teach that the first conductive 18b comprises a  $M_xX_y$  material, wherein M can be any specie other than oxygen or nitrogen (for example, tungsten (W)) and X can be nitrogen (see col. 5, lines 10-16 and 63-66). Thus, the first conductive 18b can be formed of, for example, tungsten nitride. Furthermore, Figure 5B and col. 4, lines 49-63 disclose that after the first conductive 18b, e.g. tungsten nitride, is formed on the dielectric 16a, a passivation step comprised of an  $N_2/H_2$  plasma is further performed, so that the passivation layer (18a) is created over the tungsten nitride. In addition, Agarwal et al. teach that layer 18b is optionally exposed to an oxidizing environment (see col. 7, lines 4-8). Finally, Agarwal et al. teach that an electrode 19 comprised of polysilicon is then formed over the structure (see Fig. 5B, col. 4, lines 20-24 and col. 5, lines 37-40). Therefore, Agarwal et al. anticipate the claimed limitation wherein a first conductive of the second capacitor plate is exposed to a  $N_2/H_2$  plasma prior to form the second conductive of the second capacitor plate.

Regarding claims 77, 82, 85, 97 and 100, Agarwal et al. teach a dielectric comprised of tantalum pentoxide (see col. 4, lines 34-37).

Regarding claims 79 and 94, Agarwal et al. teach a method (see cols. 1-12) comprising the step of: providing a capacitor having a first plate (14), a dielectric (16a)

over said first plate, and a first conductive layer (18b), an oxide layer (16b), a second conductive layer (19) (see Fig. 5B). Furthermore, Agarwal et al. teach that the capacitor is exposed to an  $N_2/H_2$  plasma (see Fig. 5B, col. 4, lines 20-24, col. 7, lines 20-23) and then, to a thermal process (see col. 7, lines 26-29).

Regarding claims 80 and 95, Agarwal et al. teach that the oxide layer (16b) is about 10 Å (see col. 7, lines 3-4).

Regarding claims 81 and 96, Agarwal et al. teach that the oxide layer (16b) comprises silicon oxide (see col. 4, lines 34-37).

Regarding claims 83 and 98, Agarwal et al. teach that the first conductive layer can be formed of  $M_xX_y$  material, wherein M can be any specie other than oxygen or nitrogen (for example, tungsten (W)) and X can be nitrogen (see col. 5, lines 10-16 and 63-66).

Regarding claims 84 and 99, Agarwal et al. teach a method (see cols. 1-12) comprising the step of: providing a capacitor having a first conductive (14) and a dielectric (16) on the first conductive, wherein prior to forming the dielectric layer, the first conductive is exposed to an  $N_2/H_2$  plasma (see Fig. 2D and col. 4, lines 20-24).

Regarding claims 86 and 101, Agarwal et al. teach that the first conductive layer comprises tungsten nitride (see col. 4, lines 20-27).

### ***Claim Rejections - 35 USC § 103***

➤ The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the

invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

➤ Claims 87-90 are rejected under 35 U.S.C. 103(a) as being unpatentable over Applicant's Specification in view of Sandhu et al. (US Patent No. 5,376,593).

Regarding claim 87, Applicant acknowledges that is well known in the art to form a plug (46), a first conductive (52), and second conductive layer (48) (see Figs. 7-8). However, Figures 7-8 fail to show the step of exposing the first conductive layer to an  $N_2/H_2$  plasma. Sandhu et al. teach that is well known in the art to expose a first conductive layer (90) to a nitride atmosphere such as  $N_2/H_2$  plasma prior to form the second conductive layer (50) (see col. 4, lines 49-56 and Fig. 7). Therefore, it would have been obvious to one having ordinary skill in the art at the same time the invention was made to modify Applicant's Specification to include the step of exposing the first conductive layer to a nitride atmosphere such as  $N_2/H_2$  plasma prior to form the second conductive layer. The ordinary artisan would have been motivated to modify Applicant's

Specification in the manner described above for at least the purpose of forming a semiconductor device having substantially reduced potential for current leakage.

Regarding claim 88, Applicant acknowledges that the plug comprises at least polysilicon (see page 10, lines 15-16).

Regarding claim 89, Applicant acknowledges that the first conductive comprises tungsten nitride (see page 10, lines 24-25).

Regarding claim 90, Applicant acknowledges that the second conductive comprises copper (see page 10, lines 19-20).

### ***Response to Arguments***

➤ Applicant's arguments with respect to claims 1-3 and 76-105 have been considered but are moot in view of the new ground(s) of rejection.

### ***Correspondence***

Any inquiry concerning this communication or earlier communications from the examiner should be directed to José R. Díaz whose telephone number is (703) 308-6078. The examiner can normally be reached on 9:00 - 5:00 Monday, Tuesday, Thursday and Friday.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Eddie C. Lee can be reached on (703) 308-1690. The fax phone numbers for the organization where this application or proceeding is assigned are (703) 308-7722 for regular communications and (703) 746-3891 for After Final communications.

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Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is (703) 308-0956.

JRD  
June 28, 2002



EDDIE LEE  
SUPERVISORY PATENT EXAMINER  
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